PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:
B60Q 1/14, F21M 3/20	A1	WO 91/02666
		(43) International Publication Date: 7 March 1991 (07.03.91)

(21) International Application Number: PCT/EP89/00959

(22) International Filing Date: 12 August 1989 (12.08.89)

(71) Applicant *(for DE only):* KODAK AKTIENGESELLSCHAFT [DE/DE]; Postfach 600345, Hedelfinger Strasse, D-7000 Stuttgart 60 (DE).

(71) Applicant *(for all designated States except DE US):* EASTMAN KODAK COMPANY [US/US]; 343 State Street, Rochester, NY 14650 (US).

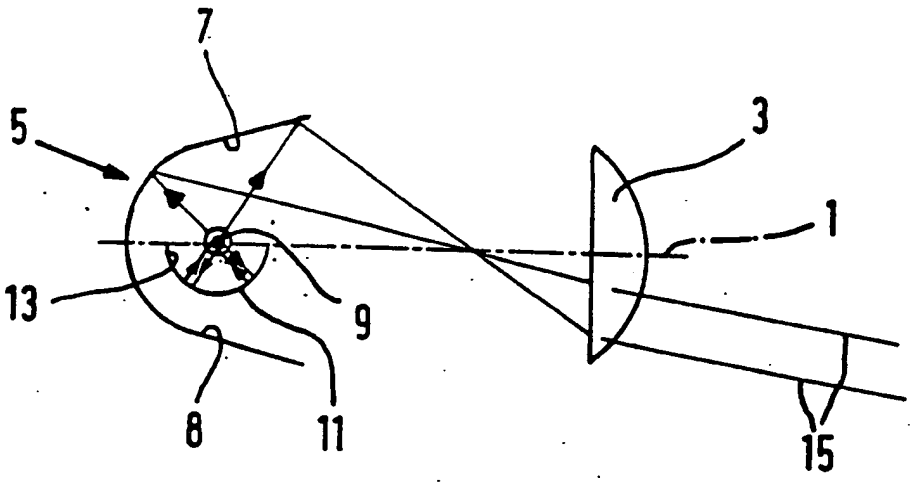
(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : STROBEL, Joseph, R. [CH/DE]; Hermannstrasse 38, D-7065 Winterbach (DE).

(74) Agent: LEWANDOWSKY, Klaus; Kodak Aktiengesellschaft, Postfach 600345, D-7000 Stuttgart 60 (DE).

(81) Designated States: AT (European patent), AU, BE (European patent), BR, CH (European patent), DE*, DE (European patent)*, DK, FI, FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), NO, SE (European patent), US.

Published
With international search report.

(54) Title: VEHICULAR HEADLIGHT



(57) Abstract

A vehicular headlight for selectively emitting a high beam or a low beam features a main reflector having a mirrored surface which is divided into an upper reflector section for producing a low beam and a lower section for producing a high beam. The light source which is provided for both the low and the high beam is associated with an auxiliary reflector the position of which can be adjusted so that the light of the light source reflected by the auxiliary reflector is directed selectively to the upper reflector section or the lower section. The upper reflector section is designed for producing an optimal low beam and the lower section for producing an optimal high beam.

DESIGNATIONS OF "DE"

Until further notice, any designation of "DE" in any international application whose international filing date is prior to October 3, 1990, shall have effect in the territory of the Federal Republic of Germany with the exception of the territory of the former German Democratic Republic.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MC	Monaco
AU	Australia	FI	Finland	MG	Madagascar
BB	Barbados	FR	France	ML	Mali
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GR	Greece	NL	Netherlands
BJ	Benin	HU	Hungary	NO	Norway
BR	Brazil	IT	Italy	PL	Poland
CA	Canada	JP	Japan	RO	Romania
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo			SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CM	Cameroon	LI	Liechtenstein	SU	Soviet Union
DE	Germany	LK	Sri Lanka	TD	Chad
DK	Denmark	LU	Luxembourg	TG	Togo
				US	United States of America

Description

VEHICULAR HEADLIGHT

The invention relates to a vehicular headlight for selectively emitting a high beam or a low beam featuring a light distribution around the headlight axis different from that of the high beam, said headlight comprising a main reflector designed to form a cavity with a mirrored inner surface, a light source arranged in front of the mirrored surface of the main reflector, and at least one auxiliary reflector designed to form a second cavity with a mirrored inner surface and having smaller dimensions than the main reflector, said auxiliary reflector being arranged in the vicinity of the light source with its mirrored surface facing same such that it reflects light emitted by the light source onto an associated area of the mirrored surface of the main reflector.

A vehicular headlight of this type is disclosed in DE-PS 1 472 523. In the known headlight the light source cooperating with the mirrored surface of the auxiliary reflector is provided for producing the low beam only. For generating the high beam, the known headlight has a second light source which is spatially separated from the light source cooperating with the auxiliary reflector and, lying in the area of the headlight axis, is arranged in the space between the mirrored surface of the main reflector and the auxiliary reflector.

The known headlight has substantial disadvantages with respect to the desired homogeneous light distribution and high intensity of light of the light beams emitted. When the high beam is produced, part of the light reflected by the main reflector is blocked by the auxiliary reflector lying in the raypath, which results in a considerable attenuation and inhomogeneity of the high beam. When the low beam is produced, the light distribution leaves much to be desired because due to using a partial section (upper half) of the mirrored surface of the main reflector, which is also used for producing the high beam, the desired asymmetry of the low beam is not achieved.

It is the object of the present invention to provide a vehicular headlight of the type considered which emits a low and a high beam of high light intensity and the desired light distribution and homogeneity.

According to the invention, the above object is attained in that the light source is provided for emitting both the high beam and the low beam and the position of the auxiliary reflector can be adjusted by means of an adjusting device and moved at least to a first position in which the light reflected by it towards the main reflector hits said main reflector in a first section of its mirrored surface provided for producing the low beam and said auxiliary reflector can also be moved to at least one second adjusting position in which the light reflected by it towards the main reflector hits said main reflector in a second surface section provided for producing the high beam.

The present invention uses a single light source which - according to the position of the auxiliary reflector adjusted - illuminates different sections of the mirrored surface of the main reflector. The engineer is now completely free to design such surface sections especially with respect to the requirements the light beam reflected by the respective surface sections must fulfil. In other words, it is up to the engineer to design the surface section used for emitting the low beam such that a low beam is produced which has optimal properties as to homogeneity, light distribution and/or asymmetry of the light/dark delimitation. On the other hand, the surface section used for the high beam can optimally be adapted to the requirements to be considered.

The use of a single light source not only means a reduction of the manufacturing and operating costs because a single lamp socket and wiring are necessary, but provides the additional advantage that as a light source also a type of lamp can be used which after switching on reaches its highest intensity of light emission only after a certain period of time, as this is for example the case with lamps operating according to the gas discharge or arc light principle. To date, lamps of this type have not been able to be used as high beam sources, because the high beam, when required, must be emitted with full intensity and without noticeable time delay.

According to claim 2, the sections of the mirrored surface of the main reflector used for the low and high beams are preferably designed as zones of different configuration.

A particularly effective optimization of the light distribution on the surfaces to be illuminated by the high and low beams is possible if according to claim 3 each of the sections of the mirrored surface of the main reflector is designed using the teaching disclosed in the international application PCT/EP 88/00196. Due to the asymmetry of the plurality of sections running through the main reflector each reflecting point of the mirrored surface of the main reflector illuminates a spot associated therewith on the surface to be illuminated. The shape of the respective sections of the mirrored surface of the main reflector is then calculated and/or determined in accordance with the teaching of the aforementioned international patent application such that for each spot of the surface to be illuminated the desired brightness and thus the desired homogeneity of light distribution and - in the case of the low beam - the desired position and asymmetry of the light/dark delimitation are achieved.

It is understood that the desired optical effects of the surface sections of the main reflector provided for the low and high beams can be achieved by using the teaching of the above mentioned international patent application applying the asymmetrical shapes of the mirrored surface section alone and/or by the mirrored surface sections and an additional optical lens element, e.g. a lens made of glass or plastic material arranged in the light exit area of the headlight, acting in combination.

In a preferred embodiment, the mirrored surface of the auxiliary reflector has a spherical shape. If the light source is arranged such that the light of the light source is imaged by the concave spherical mirror in the light source itself or somewhat offset, a maximum of light intensity both for the low and the high beam is reached because the light in its entirety is reflected towards the desired section of the main reflector except for the loss suffered by the reflection of the light in the concave mirror itself.

For the adjustment of its position, the auxiliary reflector can be mounted for rotation about an axis both for an adjusting movement combined of a translational and a rotational movement or for a mere pivotal movement. Preferably the adjusting device used for positioning operates according to the electromotive principle, e.g. by using a rotary magnet, which provides for a reliable and fast adjustment of the position at very low structural effort.

The invention will now be explained in detail with reference to embodiments shown in the drawing.

Figs. 1 and 2 show schematically simplified representations of a raypath of an embodiment in the low beam mode and the high beam mode, respectively, and

Figs. 3 and 4 show schematically simplified perspective views of the rear portions of a second and third embodiment of the headlight, respectively.

An embodiment of the headlight shown in Figs. 1 and 2 features in the front light exit area a lens 3 which is oriented substantially concentrically with respect to the headlight axis 1 and is made of glass. It is understood that a plastic lens or a light exit pane without optical effect could also be provided. On the other hand, lens 3 could also form a light exit pane, i.e. the front member of the headlight.

A main reflector 5 which, as seen in the direction of light incidence, is arranged in the rear area features an internal, mirrored surface which has a different shape in the surface section 7 above the headlight axis 1 than in the surface section 8 below the headlight axis 1. A lamp whose light source 9 is oriented at least approximately with respect to the headlight axis 1 is arranged in front of the mirrored surface of the main reflector 5.

An auxiliary reflector 11 which in the embodiment has the shape of a spherical, dome-shaped concave mirror the dimensions of which are considerably smaller than those of the main reflector 5 is adjustable so that it can be moved to a first position shown in Fig. 1 and to a second position shown in Fig. 2. In both positions light source 9 is arranged at least approximately in the area of the center of the curvature of the inner, spherical, mirrored surface 13 of the auxiliary reflector 11. In the embodiment according to Figs. 1 and 2 the auxiliary reflector 11 is adjusted from its first position shown in Fig. 1 to its second position shown in Fig. 2 by pivoting it about a horizontal axis intersecting the headlight axis 1 at right angles in the center of the curvature of the mirrored surface 13 of the auxiliary reflector 11. An adjusting device not shown in the drawing and featuring an electric motor drive is provided for producing the necessary 180° rotation between the first and second positions.

The first position of auxiliary reflector 11 shown in Fig. 1 is provided for producing a low beam 15. In this position, the light reflected by the mirrored surface 13 of auxiliary reflector 11 and directed to the main reflector 5 hits said main reflector exclusively in the upper surface section designated 7, that's to say in the same section to which also the non-reflected light is directed, i.e. the light emitted by light source 9 and reaching directly the main reflector 5. The upper surface section 7 of the mirrored surface of the main reflector 5 illuminated when the auxiliary reflector 11 is in its first position is formed such that in combination with lens 3 it produces the low beam 15 with exactly the desired light distribution on the surface to be illuminated. Due to the spherical shape of the mirrored surface 13 of auxiliary reflector 11 and the arrangement of light source 9 substantially in the center of curvature of surface 13, the rays of light source 9 impinging on surface 13 are practically reflected upon themselves, that's to say in the center of curvature of auxiliary reflector 11 an inverted and non-enlarged image of the light source is produced in the same focal plane in which also the light source is arranged. If light source 9 is a filament, it is recommended leaving a slight space between the center of curvature of mirrored surface 13 and the position of light source 9 so that the reflected image is produced directly beside the filament or, if the filament is coarsely wound, in the spaces between its windings.

In the position of auxiliary reflector 11 shown in Fig. 2 a high beam 17 is produced and thereby the lower surface section of the main reflector 5 is illuminated exclusively. Section 8 is designed particularly with respect to producing the high beam 17 and under the consideration of the optical effect of lens 3. Both the upper section 7 and the lower section 8 of the mirrored surface of main reflector 5 may also be designed such that the low beam 15 or the high beam 17 is produced without using the optical effect of lens 3 if in lieu of a lens a headlight pane without optical effect is used.

As is apparent from Figs. 1 and 2, the portions of the low beam 15 and the high beam 17 produced by reflection only penetrate the lower and upper section of lens 3, respectively. For this reason, lens 3 may be differently designed in said two sections so that in combination with the two surface sections 7 and 8, respectively, optimal light distribution is obtained in both cases.

In the embodiment according to Figs. 1 and 2 the auxiliary reflector 11 is hemispherically shaped. This is not compulsory. A different, perhaps irregularly extending marginal zone of the auxiliary reflector 11 could be selected to produce a particular shape of the light/dark delimitation of the low beam 15 which depends on the shape and position of the margin of auxiliary reflector 11 when in its first position. In lieu of the first and the second positions shown in Figs. 1 and 2, respectively, other positions of the auxiliary reflector 11 could also be used, e.g. positions in which the marginal zone of the auxiliary reflector - possibly in only one of the two positions of the auxiliary reflector - lies above or below the headlight axis 1 at a certain distance therefrom. In lieu of the straight and horizontal course of the margin of auxiliary reflector 11 shown in Figs. 1 and 2, the margin could also extend at an angle relative to the horizontal plane in at least one of the positions or in different marginal zones it could be spaced irregularly from the horizontal plane including the headlight axis 1. In such cases, in addition to the light reflected by the main reflector 5, also light reflected by the mirrored surface 13 of auxiliary reflector 11 could, without being reflected any further by the main reflector 5, directly leave the headlight as a component of the light beam emitted.

Instead of a single auxiliary reflector 11, there could be provided two auxiliary reflectors which, if required, could be mounted for movement relative to each other and could be moved to positions such that in one of such positions a major portion of or the complete amount of light of light source 9 reflected by the surface 13 directly forms the light beam emitted without having been reflected by the main reflector 5.

Fig. 3 shows a second embodiment having an elongated or tubular light source 9 extending at right angles relative to the headlight axis 1. To adjust the required position - the first position being shown in full lines, the second position in dash-dotted lines - the auxiliary reflector 11 of this embodiment must be pivoted about an axis 21 which extends horizontally, intersects the headlight axis 1 at right angles and coincides with the longitudinal axis of light source 9.

The embodiment according to Fig. 4 uses a light source 9 corresponding to that of Fig. 3 the longitudinal axis of which however substantially coincides with the headlight axis 1. In this embodiment, the auxiliary reflector 11 can be pivoted about an axis coinciding with headlight axis 1 from its first position shown in full lines to its second position shown in dash-dotted lines.

In other embodiments not shown in the drawing the pivotal axis of auxiliary reflector 11 can also be displaced normal to itself so that in both positions of the auxiliary reflector the image of the light source produced by it can be moved on different sides to the immediate vicinity of said pivotal axis.

The above description and the drawing are limited to the statement of features essential for the embodiment of the invention by way of example. As far as the features are disclosed in the description and the drawing and not mentioned in the claims, they also serve - if required - for determining the subject of the invention.

Claims

1. A vehicular headlight for selectively emitting a high beam (17) or a low beam (15) featuring a light distribution around the headlight axis (1) different from that of the high beam, said headlight comprising

a) a main reflector (5) designed to form a cavity with a mirrored inner surface,

b) a light source (9) arranged in front of the mirrored surface of the main reflector (5), and

c) at least one auxiliary reflector (11) designed to form a second cavity with a mirrored inner surface (13) and having smaller dimensions than the main reflector (5), said auxiliary reflector being arranged in the vicinity of the light source (9) with its mirrored surface (13) facing same such that it reflects light emitted by the light source (9) onto an associated area of the mirrored surface of the main reflector (5),
c h a r a c t e r i z e d in that

d) the light source (9) is provided for emitting both the high beam (17) and the low beam (15), and

e) the position of the auxiliary reflector (11) can be adjusted by means of an adjusting device and moved at least to a first position (Fig. 1) in which the light reflected by it towards the main reflector (5) hits said main reflector in a first section (7) of its mirrored surface provided for producing the low beam (15), and said auxiliary reflector (11) can also be moved to at least a second position (Fig. 2) in the light reflected by it towards the main reflector (5) hits said main reflector in a second surface section (8) provided for producing the high beam (17).

2. Headlight as described in claim 1, characterized in that the mirrored surface of the main reflector (5) is divided into at least two zones of different configuration of which the one that is illuminated by the auxiliary reflector (11) when in its first position is designed as a first section (7) for producing the low beam (15), and the other which is illuminated by the auxiliary reflector (11) when in its second position is designed as a second section (8) for producing the high beam (17).

3. Headlight as described in claim 2, characterized in that each of the two sections (7 and 8) of the mirrored surface of the main reflector (5) is designed such that the longitudinal sections running through the headlight axis (1) and the cross-sections normal to said axis (1) extend asymmetrically to the headlight axis (1).

4. Headlight as described in any of claims 1 thru 3, characterized in that at least the larger portion of the first section (7) of the mirrored surface of the main reflector (5) lies above the horizontal plane including the headlight axis (1) and in that at least the larger portion of the second section (8) of the mirrored surface of the main reflector (5) lies below said horizontal plane.

5. Headlight as described in any of claims 1 thru 4, characterized in that the mirrored surface (13) of the auxiliary reflector (11) is spherically shaped.

6. Headlight as described in claim 5, characterized in that at least one position of the auxiliary reflector (11) is selected such that the image of the light source (9) produced by the auxiliary reflector (11) lies in the area of said source (9).

7. Headlight as described in claim 5, characterized in that in at least one position of the auxiliary reflector (11) the image of the light source (9) lies slightly offset said source (9).

8. Headlight as described in any of claims 1 thru 7, characterized in that the auxiliary reflector (11) can be pivoted about a rotational axis (21) to vary its position.

9. Headlight as described in claim 8, characterized in that the rotational axis (21) extends horizontally.

10. Headlight as described in claim 9, characterized in that the rotational axis (21) lies in the horizontal plane including the headlight axis (1).

11. Headlight as described in any of claims 8 thru 10, characterized in that the rotational axis (21) and the headlight axis (1) form an angle of 90°.

12. Headlight as described in any of claims 8 thru 10, characterized in that the rotational axis (21) extends parallel to the headlight axis (1).

13. Headlight as described in any of claims 8 thru 12, characterized in that for varying the position of the auxiliary reflector (11) the rotational axis (21) is displaceable.

14. Headlight as described in any of claims 1 thru 13, characterized in that at least one optical lens element is arranged in the raypath of the light emitted by the mirrored surface of the main reflector (5).

15. Headlight as described in claim 14, characterized in that the optical lens element comprises two differently designed areas for the high and the low beam (17,15).

16. Headlight as described in claim 15, characterized in that the optical lens element is a lens (3) manufactured of glass or plastic material and spatially associated with the front member of the headlight.

17. Headlight as described in any of claims 1 thru 16, characterized in that the adjusting device for the auxiliary reflector (11) is provided with a rotary magnet.

Fig.1

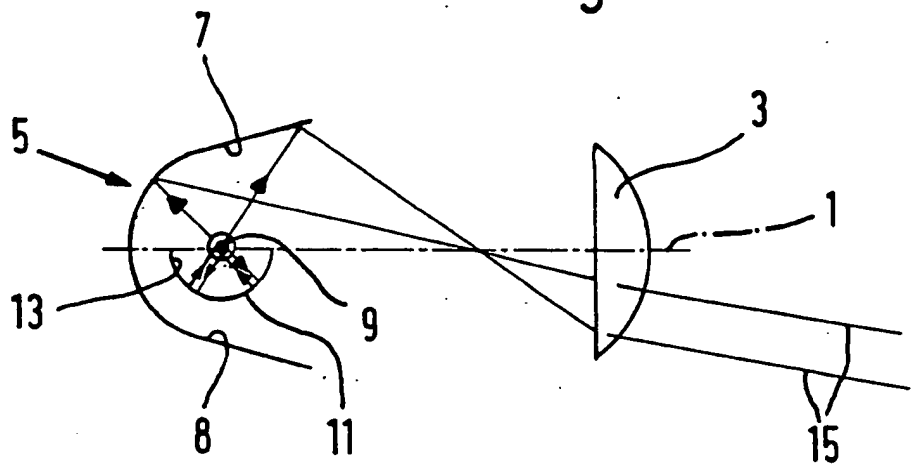
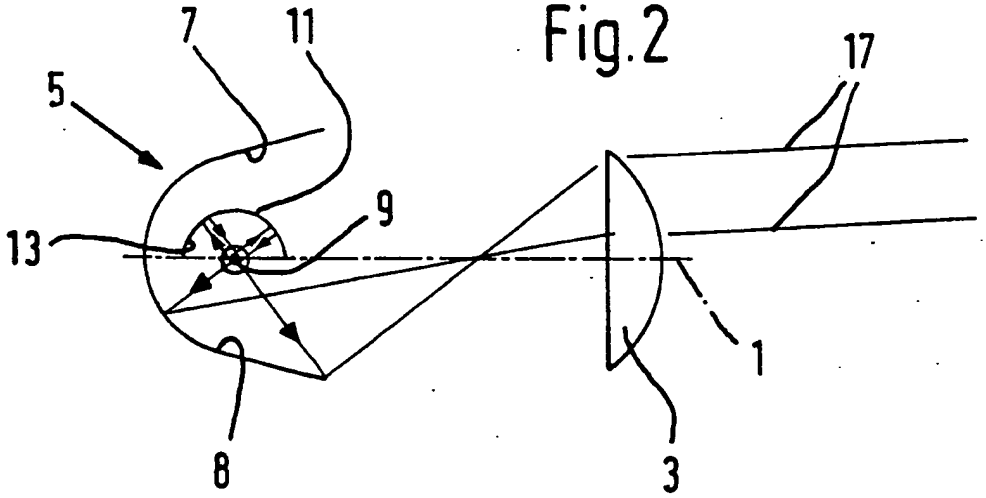


Fig.2



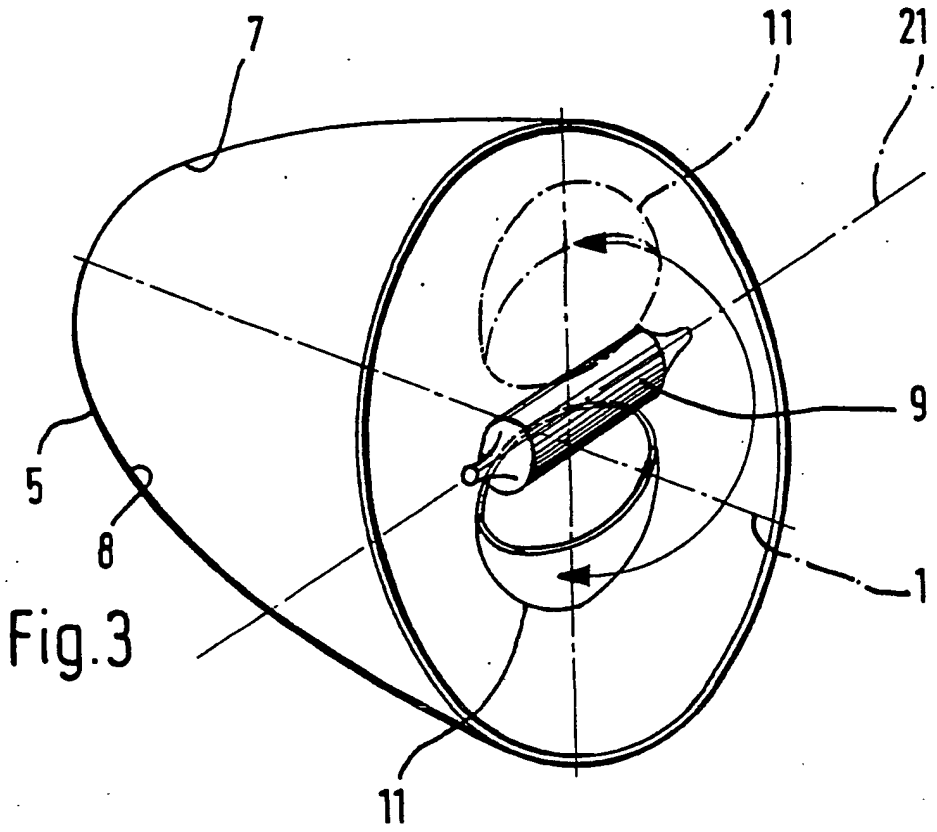


Fig.3

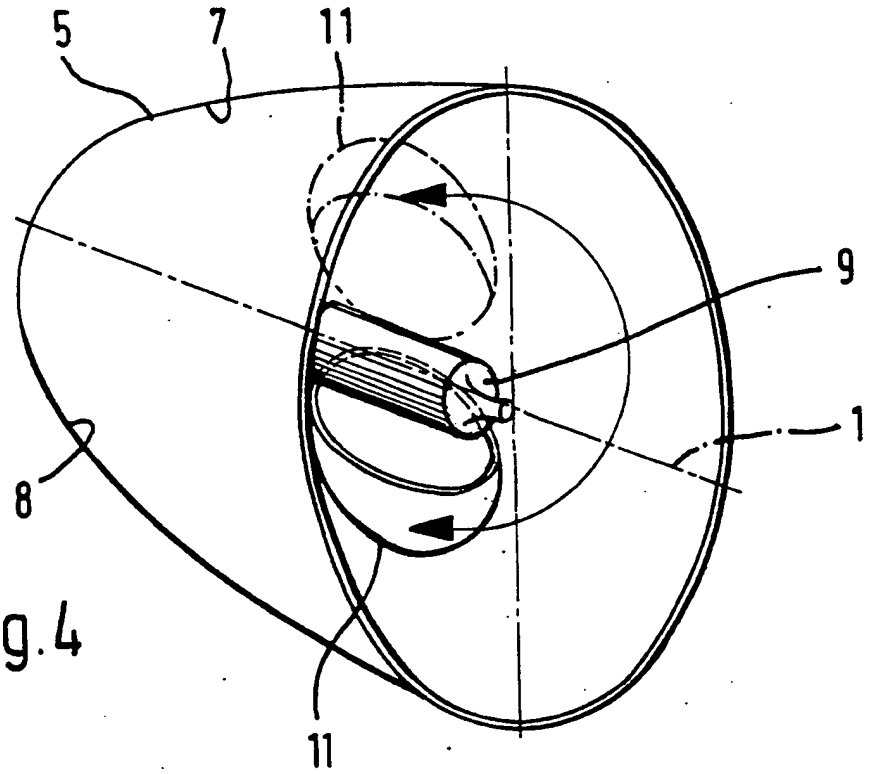


Fig.4

INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 89/00959

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 60 Q 1/14, F 21 M 3/20

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC5	B 60 Q, F 21 M

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 1369227 (WILLIAM ELLSWORTH) 22 February 1921, see the whole document	1-17
A	US, A, 1397803 (H.E. ENSOR AND J. SAMPSON) 21 November 1922, see the whole document	1-17
A	FR, A, 563388 (SOCIETE DES PHARES ET EQUIPEMENTS ELECTRIQUES) 4 December 1923, see the whole document	1-17

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
12th February 1990	17 AVR. 1990
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	MISS T. TAZELAAR

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	DE, C, 250574 (FIRMA CARL ZEISS) 10 September 1912, see the whole document -- --------	1-17

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/EP 89/00959

SA 30916

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 28/02/90 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 1369227	22/02/21	NONE	
US-A- 1625932	26/04/27	NONE	
FR-A- 563388	04/12/23	NONE	
DE-C- 250574	10/09/12	NONE	

EPO FORM P0479

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82